Space Weather Forecast

Issued on Tuesday, 17 January 2023 at 00:40 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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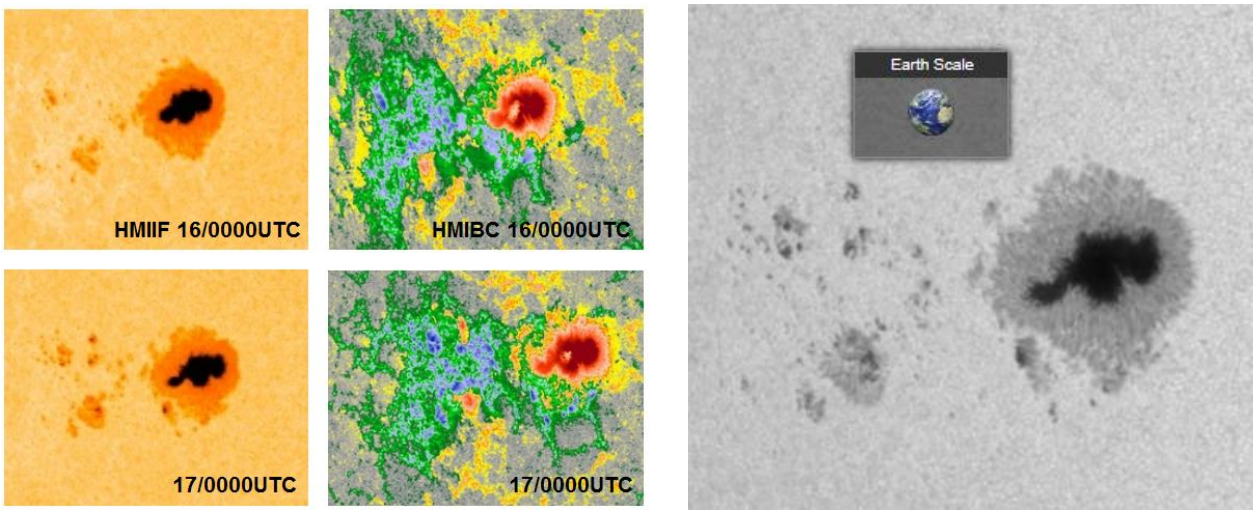
Space Weather Forecast Headline: Further Minor/Moderate Radio Blackouts likely. Risk of Minor Geomagnetic Storm rising from midweek.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity became low through the UTC day of Monday 16 January, with X-ray flares peaking with a common-class flare at 16/0923UTC. This flare emanated from a sunspot in the southwest of the Sun, which has continued its recent trend of supplying flares despite an apparent reduction in complexity and while undergoing areal decay. This group was one of up to ten on the facing side at present, with a potential new unnumbered region also developing in the northeast.

Probably the main development in terms of sunspot regions on the Sun in the past day has been the areal growth and trailer spot proliferation of a large group in the southeast. While this sunspot region was perhaps the most noteworthy in its size and behaviour, all of the groups on the Sun were at least magnetically bipolar in nature. Despite this, there was a notable relative lack of activity compared to the recent past, perhaps because of these spot groups' maturity and/or slight decaying tendencies.

Figure 1: Left four-up: Visible light and false-colour magnetic polarity satellite imagery of the most-changed sunspot region in the past 24 hours, a large group in the Sun's southeast. Despite this growth, no significant flares were produced from this region in the past 24 hours. Right: Black and white visible imagery comparing the same region at 17/0000UTC with Earth for scale. The individual convective cells can be seen in the main spot's penumbra (grey region surrounding the main black spot).



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No new Earth-directed Coronal Mass Ejections (CMEs) have been observed in available satellite imagery. At the very end of the period, around 16/2330UTC a small 'filament' disappeared from the vicinity of the new unnumbered sunspot in the northeast. At the time of writing it is not yet clear as to whether this feature left the immediate solar environment or not, but this will be watched for. There are numerous mostly small filaments (arcs of plasma - possible CMEs should they lift off) on the Sun at present, however the largest currently straddles the solar meridian near 30 South and is probably the main monitoring in this vein.

Solar Wind / Geomagnetic Activity: The solar wind showed possible waning CME effects. The culprit is not certain, but may be related to the 11 January CME which was possibly misdiagnosed as arriving earlier over the UTC weekend.

The solar wind speed showed an initial slight rise to Elevated levels before gradually waning over much of the rest of the period to become Slightly Elevated. The number of particles comprising the solar wind showed an early peak before returning to long term background into the UTC evening. The magnetic field associated with these particles behaved relatively erratically, with an initial peak later repeating around the middle of the UTC day, before undergoing a more lasting reduction with time. The north-south component was less unsettled, showing an overall trend from co-alignment with Earth's field to start the period, through anti-alignment - this, save for a blip back into aligned territory with the second peak.

The net effect of the above solar wind measures was for an erratic tendency in geomagnetic activity overall, peaking just below Minor Storm G1 in the 00-03UTC interval.

Energetic Particles / Solar Radiation: No solar radiation storms were observed.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be moderate, with a daily slight chance of reaching high levels. Although one of the more active regions departs the front side by midweek UTC, the sheer weight of current and expected eastern solar hemisphere arrivals should serve to compensate.

Solar Wind / Geomagnetic Activity: Solar winds are expected to soon revert to a slow regime, resulting in increasingly quiet geomagnetic activity on Tuesday 17 January, perhaps the most reliably settled day of the forecast. Later on Wednesday 18 January, a fast wind is expected, which may combine with the 14 January CME into Thursday 19 January, giving a likely Minor Geomagnetic Storm G1 before waning into the final day of the forecast.

Energetic Particles / Solar Radiation: Solar radiation will most likely remain at background levels, but with a slight chance of enhancements to S1 or greater through the period due to a number of magnetically complex sunspot regions on the Sun.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	40	60	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	70	70	70	70
Very Active	R3 to R5 X	No	10	10	10	10

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	20	20	20	20
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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